MADROÑO, Vol. 63, No. 2, pp. 3–206, 2016

PLANT DIVERSITY AND ENDEMISM IN THE CALIFORNIA FLORISTIC PROVINCE

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ABSTRACT

The California Floristic Province (CFP) is an area of high biodiversity and endemism corresponding roughly to the portion of western North America having a Mediterranean-type climate. High levels of diversity and endemism in the CFP are attributed to the unique geo-climatic setting of the region. In recent years, much has been learned about the origins of plant diversity in western North America. This work, however, has been hindered by a focus on political rather than biotic regions, such that much more is known about diversity and endemism in the state of California than the natural biotic region represented by the CFP. Here we present a preliminary list of native land plants (vascular plants and bryophytes) found in the CFP, as well as an analysis of diversity and endemism patterns at the level of both species and minimum rank taxa (MRT; species and infraspecific taxa). A total of 6,927 MRT are native to the CFP, including 6,143 vascular plants and 784 bryophytes. Of these, 2,612 vascular plants are endemic to the CFP (42%) compared to 37 endemic bryophytes (5%). Finally, 2,506 native CFP vascular plant MRT (41% of the CFP flora) and 454 CFP bryophyte MRT (58% of the CFP flora) are found outside California in the Oregon and Baja California parts of the CFP. This high degree of sharing across political boundaries among both vascular plants and bryophytes highlights the cohesiveness of the CFP, and the need to focus more research effort on biotic regions.

RESUMEN

La Provincia Florística de California (PFC) es una zona de alta biodiversidad y endemismo que en gran medida corresponde con el clima de tipo mediterráneo del oeste de Norteamérica. Los altos niveles de diversidad y endemismo de la PFC se les atribuyen al entorno geo-climático único de esta región. En los últimos años han habido grandes avances en el conocimiento sobre los orígenes de la diversidad de plantas en el oeste de Norteamérica. Este conocimiento, sin embargo, se ha visto limitado por un enfoque en las regiones políticas más que en las bióticas, y por lo tanto se sabe mucho más acerca de la diversidad y endemismo en el estado de California que en la región biótica natural, representada por la PFC. Aquí presentamos una lista preliminar de plantas terrestres nativas (plantas vasculares y briófitas) presentes en la PFC, así como un análisis de los patrones de diversidad y endemismo a nivel de especies y de los rangos mínimos de los taxones (RMT, especies y taxones infraespecíficos). Un total de 6,927 RMT son nativos de la PFC, incluyendo 6,143 plantas vasculares y 784 briófitas. De ellas, 2,612 plantas vasculares son endémicas de la PFC (42%) comparadas con 37 briófitas endémicas (5%). Finalmente, 2,506 plantas nativas PFC vasculares RMT (41% de la flora de la PFC) y 454 PFC briófitas RMT (58% de la flora de la PFC) se encuentran fuera del estado de California en las zonas de la PFC en el estado de Oregon y en Baja California. Este alto grado de intercambio a través de las fronteras políticas entre plantas vasculares y briófitas destaca la cohesión de la PFC, y la necesidad de centrar los esfuerzos de investigación en las regiones bióticas.

Key Words: Baja California, biotic region, Mexico, Nevada, Oregon, richness, species.

The California Floristic Province (CFP; Fig. 1) encompasses an area of exceptionally high plant diversity and endemism, corresponding to the part of western North America that has a Mediterranean-type climate — including most of California, as well as parts of southern Oregon, western Nevada, and northern Baja California, Mexico (Howell 1955; Raven and Axelrod 1978; Fig. 1). We adopt a phytogeographic approach to defining the CFP. Our approach is in line with past hierarchical schemes of phytogeographic classification (Engler 1879; Good 1974; Takhtajan 1986). In these schemes, provinces are at the lowest level, and are recognized by their distinctive plant life. However, our definition of the CFP, like most modern ones (Howell 1955; Raven and Axelrod 1978), also encompasses climate in defining the province. Although this concept could be construed as circular, since plant geographic distributions are often used as evidence to define the borders of floristic provinces, we believe that floristic provinces are valuable ecological hypotheses that deserve scientific attention and testing.

The origin of high diversity and endemism in the CFP has long fascinated North American botanists, leading to an extensive and varied literature (Howell 1955, 1957; Stebbins and Major 1965; Raven and Axelrod 1978; Kruckeberg 1986; Viers et al. 2006; Ackerly 2009; Thorne et al. 2009; Kraft et al. 2010; Lancaster and Kay 2013). Overall, research has focused on the problem of how the environmental history of the CFP region has contributed to high diversity and endemism, particularly the influence of climate, alone or in combination with other abiotic factors such as soils and topography (Stebbins and Major 1965; Raven and Axelrod 1978; Kruckeberg 1986; Harrison and Inouye 2002; Harrison and Grace 2007; Kraft et al. 2010; Anacker et al. 2011; Anacker and Harrison 2012a, 2012b).

Despite recent gains in our understanding of CFP diversity and endemism, many critical questions remain (Ackerly 2009). Unfortunately, this research has been hindered by a lack of accurate information on the species that are present in the CFP, because floristic research has focused on political units, particularly the state of California (Baldwin et al. 2012), rather than biotic regions. To aid research on plant diversity and endemism in the CFP, we have compiled a preliminary list of land plants (Embryophyta) native to the region, along with information on their putative status as CFP endemics. We also analyze diversity and endemism in the CFP, providing the first such summary since the seminal work of Raven and Axelrod (1978).

While our work represents the first attempt at a comprehensive list of the native and endemic plants of the CFP, it is by no means a final or perfect list, and should not be treated as a formal checklist for the CFP. As described in the Discussion, obtaining the best technically feasible list of the native flora of the CFP would require a comprehensive floristic assessment of the CFP on the scale of the Jepson eFlora (Jepson Flora Project 2015), with contributions from taxonomic experts able to assess the circumscriptions of taxa that may have populations in two or more